NanoVNA

Don G3XTT gets to grips with a handy and cheap piece of test equipment.

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What is a NanoVNA? Many of you will know but many may not. According to Wikipedia, a Vector Network Analyser is a form of RF network analyser consisting of a signal generator, a test set, one or more receivers and a display. Most VNAs have two ports, permitting measurement of four S (scattering) parameters (S11, S21, S12 and S22).

If that all sounds confusing, then you might also not be too pleased that a VNA also requires calibrating before use.

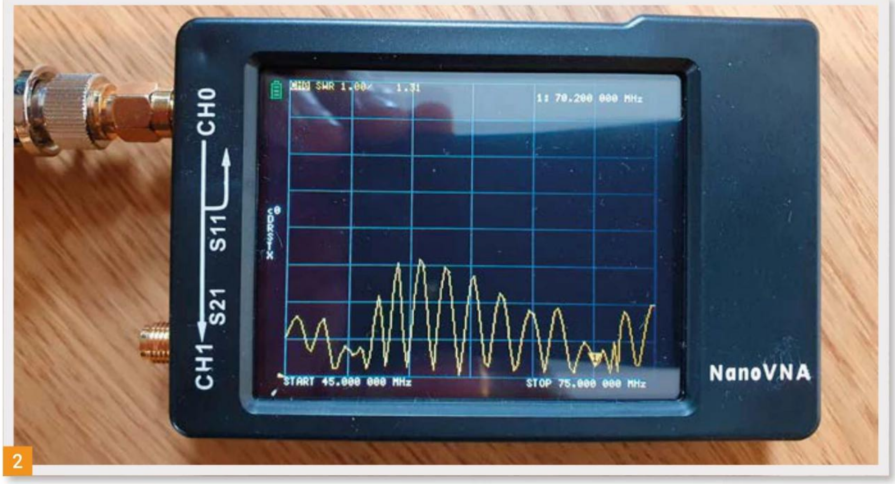
All of which sounds rather complex when you could simply buy and use a standard antenna analyser, which nowadays will show not only a plot of VSWR, but, typically, impedance data too.

It's certainly true that you can do a lot with a standard antenna analyser, including, for example, cutting coax to a resonant length, figuring out the velocity factor of coax and more, so not just actually measuring your antenna.

However, a VNA can do a lot more than that, enabling you to build and test baluns and RF chokes, check out filters, measure cable length (particularly useful if you have a break in your coax) and much more. Read on!

NanoVNA
Very tiny handheld Vector Netw
HOME MENU
DISPLAY
MARKER
STIMULUS
CAL
RECALL
CONFIG
TOUCH CAL
TOUCH TEST
SAVE
VERSION
>DFU
<BACK
RECALL 0
RECALL 1
RECALL 2
RECALL 3
RECALL 4
<BACK
CH0
S11
S21
CH1
NanoVNA

1


CH0
S11
S21
CH1
CH0 SWR 1.00/ 1.31
1: 70.200 000 MHz
START 45.000 000 MHz
STOP 75.000 000 MHz
NanoVNA

2

What You Get

The NanoVNA arrives nicely packaged, **Fig. 1**, with two USB leads, a carrying strap, two SMA to SMA leads, a through connector and three loads – an open circuit, a short circuit and a 50Ω load. These latter are for calibration purposes. The only enclosed instructions are a sheet with the menu tree. However, the website (below) contains a wealth of information, including a user manual. It has to be said that the Chinese-English of the user manual leaves quite a bit to be desired, although that doesn't detract from the underlying information.

nanovna.com

However, when presented with the VNA for the first time, if you haven't come across one before, it can be somewhat intimidating. The trick, as so often nowadays, is to watch one or more YouTube videos, which will give you a far better understanding of what the device can do and how to use it in anger. Here are a couple I found helpful although there are plenty to explore:

https://tinyurl.com/y9kx8aqn
https://tinyurl.com/y7t37tab

To give an example of the sort of measurement that can be made, the plot, **Fig. 2**, shows a VSWR plot of the reviewer's 4m and 6m Yagi, from 45.5 to 70.5MHz. The two resonances, around 50MHz and 70MHz can be seen clearly.

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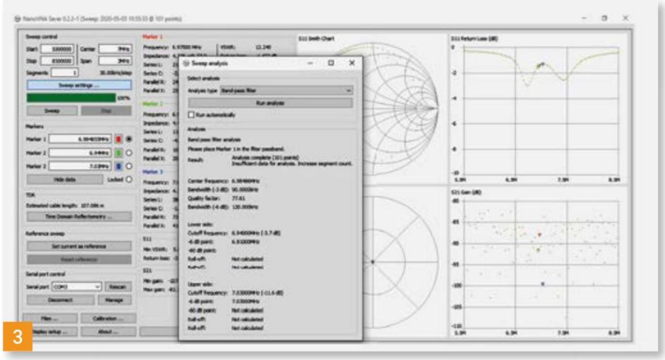
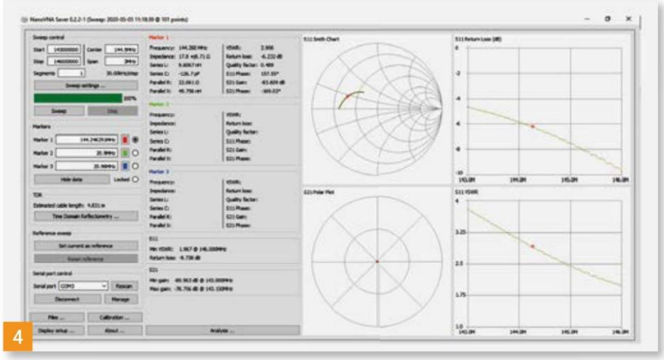
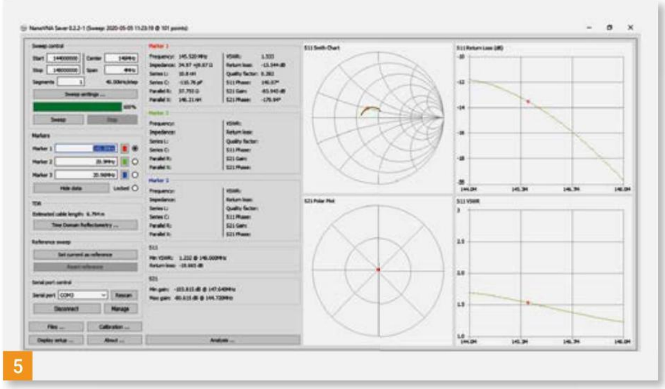


3



4



5

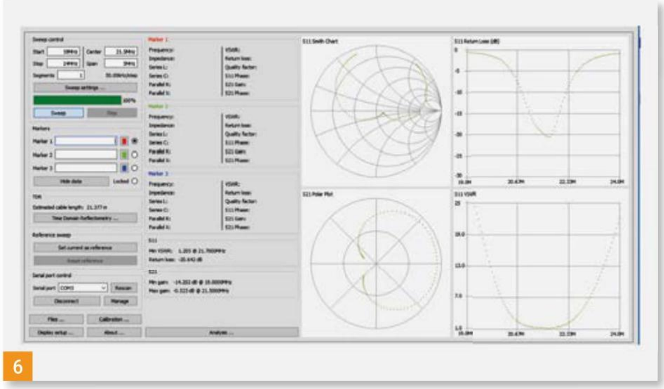


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Fig. 1: The NanoVNA on arrival.
Fig. 2: VSWR plot of the author's 4/6m Yagi.
Fig. 3: Characterising a 7MHz bandpass filter.
Fig. 4: Plot for 2m vertical, on wooden cupboard.
Fig. 5: Plot for same 2m vertical but on metal filing cabinet.
Fig. 6: VSWR and return loss plot for 21MHz bandpass filter.

Specification

The NanoVNA covers a very wide frequency range, from 50kHz to 900MHz, far wider than all but the most expensive antenna analysers. It can measure a number of parameters, from showing a Smith chart, to phase and delay measurements and, of course, SWR. And, as you'd expect, it measures reactance.

In Use

The NanoVNA came ready-charged so I could put it to use immediately. I quickly came to the conclusion that the thumbwheel is a bit of a challenge to use, while the touchscreen controls are a bit on the small side for my chunky fingers. So, I resorted – successfully – to a stylus.

The first job is to calibrate the VNA. The videos make a point that measurements at the top of end of the frequency range are more sensitive than those at HF. Keeping the connectors clean, tightening the SMA connectors correctly and general attention to detail become important if you want accurate measurements in the hundreds of Megahertz. I rather suspect, though, that the majority of *PW* readers will be using the device at more modest frequencies and that high accuracy is less important. But be aware that, despite its modest price, this is a semi-professional instrument in that it can, if properly treated, give accurate measurements across a very wide range of frequencies.

Calibration is quick and easy. But to use the NanoVNA, most of us will need to connect to N-type, PL-259 or BNC connectors so some sort of adapter will be essential.

With the PC

The NanoVNA is small enough to take out into the field with you although it is fairly fragile and certainly not weatherproof, so handle with care. But it really comes into its own if you use it in conjunction with your PC.

Indeed, for the sake of taking screenshots, I have resorted to the PC for some of the tests I did. The plot, **Fig. 3**, shows a 7MHz bandpass filter under test. The pop-up window shows an analysis specifically for a bandpass filter, telling me that it has a centre frequency of 6.98MHz and calculating the roll-off to either side.

I then decided to check out a 144MHz mobile antenna that I have, with magmount. Interestingly, the first plot, with the antenna on top of a wooden cupboard, **Fig. 4**, shows a high VSWR in the 2m band – a bit worrying. But as soon as I transferred the antenna to a metal filing cabinet the results, **Fig. 5**, were much more what I would have expected, albeit the antenna seems to be resonant out of the top of the band. Maybe on a car it would come out OK!

Finally, and to check out measurements using both ports (which not all VNAs have), I measured the characteristics of a 21MHz bandpass filter. You can see the results in **Fig. 6**.

Relationship to VNWA

I ought to just mention that, according to the NanoVNA designer's blog (see below, select English), he used the same bridge and mixer circuitry as in DG8SAQ's well-known VNWA. The latter is, of course, a much more substantial beast, works up to 1.3GHz and costs considerably more than the NanoVNA. It is manufactured and sold by SDR Kits.

https://tinyurl.com/yceyqra6
sdr-kits.net

Conclusions

For its price, this is a remarkable piece of test equipment and a worthwhile addition to any shack. It lends itself to a wide variety of uses, from circuit analysis to checking antennas and feedlines.

While many versions of the NanoVNA are available from China on eBay and Amazon, the product reviewed here is sold and supported in the UK by Mirfield Electronics and sells for just £49.95. My thanks to Mirfield for the loan of the review product.

www.mirfield-electronics.co.uk

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